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(54) Title: TOOLS (57) Abstract A plastics tool formed from a casting resin and having a working face which comprises a pre-formed metal sheet.		

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Tools

The present invention relates to plastics tools having a metal surface.

Tools made from epoxy resins and polyurethane resins are well known. In use they have some limitations which are imposed by considerations of thermal- and chemical- stability and mechanical durability. This is particularly true in the construction of deep-draw vacuum forming tools, polyurethane- and other foam moulds, pre-preg lay up tools, polyester-cold press and resin-injection tools, rubber vulcanization tools, thermoplastic injection tools, polystyrene foam moulds, construction tools for decorative cladding panels and for electrodes for spark erosion processing.

In order to reduce these problems, tools with a metal face have been proposed. These have been made by flame spraying of a nickel-based alloy, or by bismuth-tin by applying electroform sheets from baths. Each of these three methods carry high capital investment costs. Also the two spraying processes are subject to limitations associated with the thickness and evenness of the resulting metal layer and the temperature resistance of the final tool.

We have now developed a tool which overcomes the above problems, gives advantages associated with all-metal tools but are considerably cheaper, and which can be readily made by mass production.

Accordingly the present invention provides a plastics tool formed from a coating resin and having a working face which comprises a pre-formed metal surface.

The pre-formed metal surface may be of any derived metal such as aluminium, steel, stainless steel, galvanised steel, custom textured sheet (e.g. simulated leather) or copper.

The tool may be made by producing a sheet metal component in the desired shape, holding the metal in place by means of a suitable locating frame and then filling the remaining volume of the tool with a casting resin.

The sheet metal is preferably abraded or eroded on the reverse side, i.e. the side which will be in contact with the coating resin, for example by sand blasting. It may be subsequently degreased with a solvent. This allows the casting resin to adhere better to the reverse side.

If desired, and depending on the intended use, heating or cooling pipes, e.g. copper may be attached to the reverse side of the sheet metal before introducing the casting resin. The pipes may be affixed by soldering or by using a slightly flexible adhesive, especially an epoxy adhesive.

If desired a metal plate may be attached to the rear of the tool.

The tool can be used in various ways and, depending on the use, the design can be modified.

For example if it is to be used in vacuum moulding, only a thin layer, e.g. 5-10mm of casting resin is needed directly on the back of the metal sheet. Attached to the casting resin may be a porous mixture of, for example, an epoxy casting resin and an aluminium granulate, e.g. of 3-5mm mesh size in a mixing ratio of 1000 parts by weight aluminium granulate to 108 parts by weight of resin, i.e. just sufficient to enable the granules to stick together and produce a porous structure. After hardening and demoulding, all that is needed is the drilling of the necessary vacuum holes, e.g. 0.3 to 1.0mm diameter through the metal sheet and the 5-10mm casting resin as far as the porous backing. A vacuum line can then be attached via the porous backing.

In order to make a large number of the tools a master model or a sheet metal component is made, from which is constructed a matching punch, die-ring and die with a polyurethane mass casting system or an epoxy casting system, on a core of cast iron, Kirksite, or aluminium, to manufacture the required sheet metal forming tool. This may then be used on a hydraulic press or a Quintus press for pressing suitable metal sheets of the desired thickness and quality, to the desired profile. These pressed sheets are then used to make the tool as described above.

Suitable casting resins for making the tool of the invention, and also the master tool, are filled polyurethanes and filled epoxy resins. Suitable fillers include hydrated alumina and metal powders such as iron and aluminium. The iron and aluminium fillings are especially

suitable in bisphenol A epoxy resins cured by a liquid amine. Hydrated polyurethanes may be used in polyurethanes or epoxy resins.

The invention is illustrated by way of Example, with reference to the accompanying drawings in which:-

Fig 1 shows a shaped metal sheet, and

Figs 2 and 3 show tools of the invention.

Referring to the drawings, shaped metal sheet 10 is formed by stamping using a master punch and die which in turn is made by conventional methods. Fig 2 shows heating or cooling tubes 12 preferably copper affixed to the rear side of sheet 10. Casting resin 14 forms the back of the tool. The number of pipes 12 depend on the size of the tool.

Fig 3 shows sheet 10 with a thin backing layer of casting resin 16 which in turn is backed by a porous layer 18 formed from aluminium granules 20 which are stuck together by means of a resin. Holes 22 (three shown) are drilled through sheet 10 and resin 16 as far as porous layer 18. Porous layer 18 is surrounded by an impervious covering 24 through which it is attached to a vacuum line 26, thereby forming a vacuum mould. Covering 24 is partially cut away to show the porous layer 18.

Claims

1. A plastics tool formed from a casting resin and having a working face which comprises a pre-formed metal sheet.
2. A tool as claimed in claim 1 in which the metal is aluminium, steel, stainless steel, galvanised steel, custom textured sheet or copper.
3. A tool as claimed in claim 1 or 2 in which heating or cooling pipes are affixed to the rear of the metal sheet in contact with the casting resin.
4. A tool as claimed in claim 1 or 2 in which a porous layer is affixed to that face of the casting resin furthest from the metal sheet.
5. A tool as claimed in claim 4 in which holes are drilled through the metal sheet and the casting resin.
6. A tool as claimed in claim 5 or 6 in which the porous layer is formed from aluminium granules and a resin.
7. A tool as claimed in any one of claims 4 to 6 which comprises means for attaching the tool to a vacuum line.

8. A tool as claimed in any preceding claim in which the casting resin is a filled polyurethane or a filled epoxy resin.
9. A tool as claimed in claim 1 substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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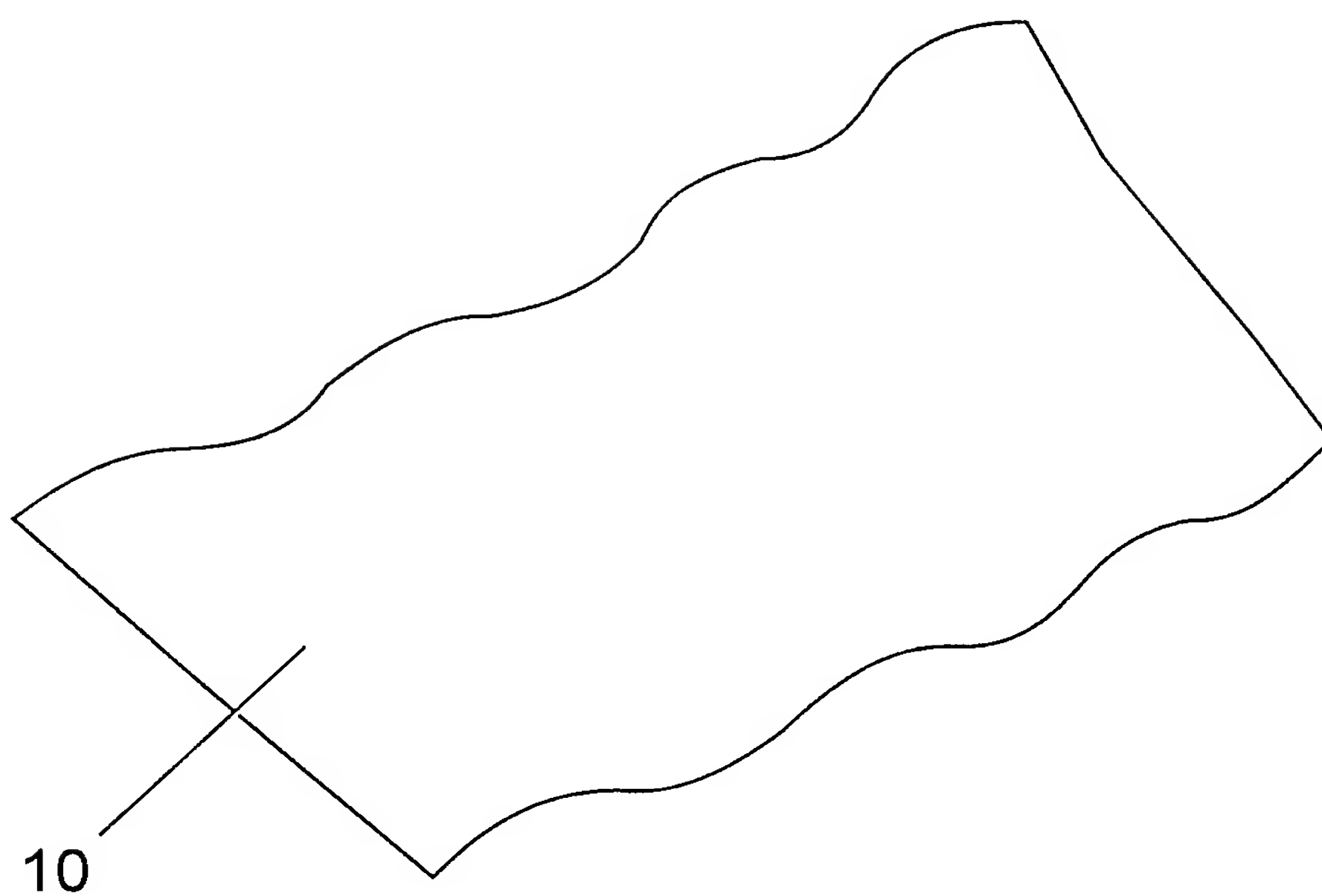


Fig. 1

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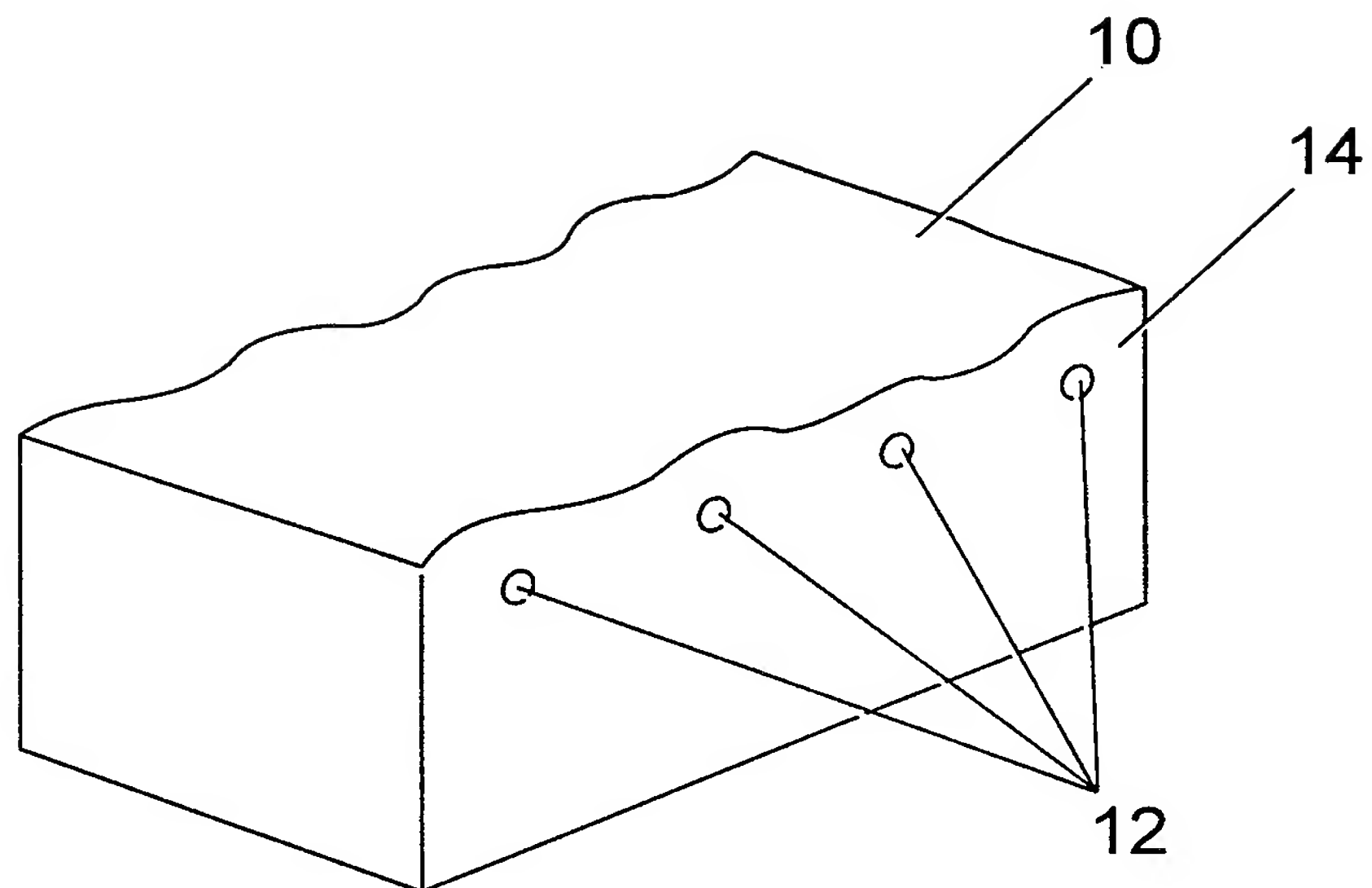


Fig. 2

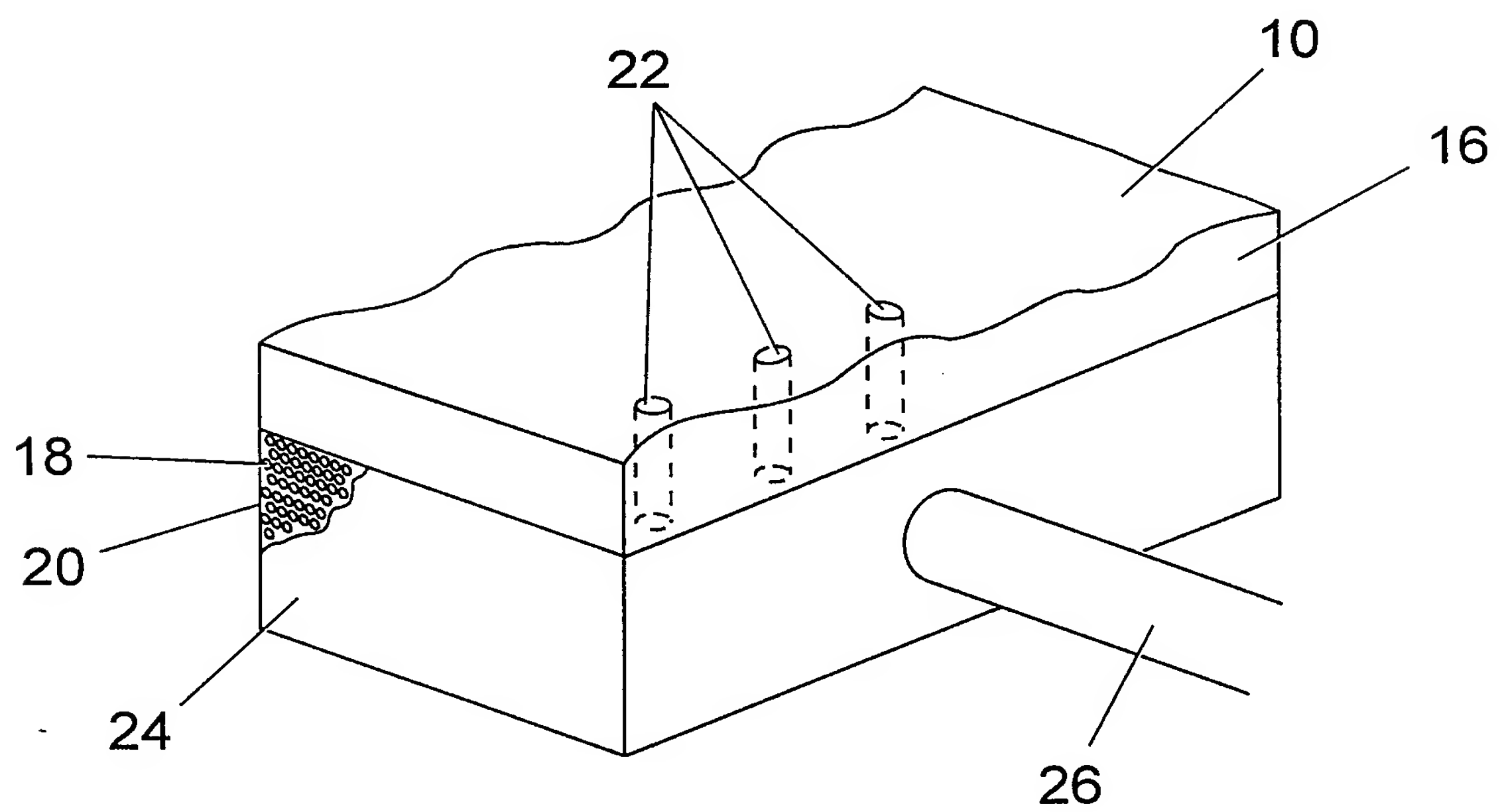


Fig. 3